

Patent
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REMARKS

Claims 14-15 and 17-29 are pending in this application. Claims 17, 19-21 and 27-28 have been amended. Claim 14 is the only independent claim.

Section 112, second paragraph rejection

Claim 17 was rejected under 35 USC 112, second paragraph, as indefinite. This issue has been addressed in the foregoing amendments made to Claim 17. Withdrawal of the Section 112 rejection is therefore respectfully requested.

Section 103(a) Rejection

Claims 14-15 and 18-29 were finally rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,452,230 (Boden) in view of US Patent 6,608,350 (Kinzer). This rejection is hereby respectfully traversed and reconsideration is requested.

Independent Claim 14 is directed to a method of forming a power MOSFET comprising the steps of providing a substrate of a first conductivity type, depositing an epitaxial layer on the substrate, the epitaxial layer having a first conductivity type, forming first and second body regions in the epitaxial layer to define a drift region therebetween, the body regions having a second conductivity type, forming first and second source regions of the first conductivity type in the first and second body regions, respectively, forming a plurality of trenches in the drift region of the epitaxial layer, *epitaxially depositing in the trenches a material having a dopant of the second conductivity type*, the trenches extending toward the substrate from the first and second body regions and diffusing at least a portion of the dopant from said trenches into portions of the epitaxial layer adjacent the trenches.

The Final Action notes on page 3 that "Boden does *not* disclose epitaxially depositing in trenches a material having a dopant of the second conductivity type and diffusing at least a portion of said dopant from said trenches into portions of the epitaxial layer adjacent the trenches". The Action then turns to the alleged teachings of Kinzer, stating that "Kinzer discloses depositing in trenches a material 4, fig. 1, having a dopant of the second conductivity type...and diffusing at least a portion of said dopant from said trenches into portions of the epitaxial layer 2 adjacent to the trenches 2, fig. 1".

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Applicant respectfully submits that (1) Boden does not teach or suggest the elements alleged in the Action to be taught therein, and (2) Kinzer does not teach or suggest depositing a material labeled 4 in the trenches 3 - instead, in Kinzer the "sidewalls and bottoms of each of trenches 3 are doped p-type by any suitable process" (col. 2, lines 25-26) - then the "trenches 3 are filled with dielectric material" (col. 2, line 32). Since "region 4" was already present, but doped n-type before the p-type dopant was introduced, it is epitaxial, but from the deposition of epitaxial layer "2".

Therefore, Kinzer does *not* provide the requisite teaching of this element, that has been acknowledged in the Action to be missing from the teachings of Boden.

The Examiner directs Applicant to "Beyer '851, Balasubramanian '853, Sparks '461, Beyer '284 and Beyer '531" as illustrating that "it would have been obvious to one of ordinary skill in the art to replace the teach of Boden and Kinzer with epitaxial silicon deposition in trench, because it would have produced the same structure as claimed and such epitaxial silicon method is well documented in the art...". Applicant respectfully disagrees with this assertion.

First, in Beyer '851, it is *polysilicon*, not epitaxial silicon, that is deposited (col. 5, lines 50-55). It appears that the Examiner may be confused by the wording therein. As for Balasubramanian '853, only *a portion of* a thin layer of conformal layer 20 is converted to a single crystal silicon, not a full trench of polysilicon. In Sparks '461, only a thin *layer at the bottom of the trench* is epitaxially deposited. In Beyer '284, the trench is filled with epitaxial silicon, but it is *undoped* -- also, the trench has a sidewall liner of SiO₂. Finally, in Beyer '531, the deposited epitaxial layer has defects at its outer edge that must be removed -- Beyer '531 may illustrate how they can be removed -- however, the resulting structure is a trench with a dielectric coating on the sidewalls and an epitaxial silicon "core" -- which is, of course, quite different from a trench full of epitaxial silicon.

For all of the foregoing reasons, Applicant respectfully submits that independent Claim 14 is patentable over any permissible combination of the teachings of Boden and Kinzer.

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Dependent Claims 15 and 17-29 are believed to be clearly patentable for all of the reasons indicated above with respect to Claim 14, from which they depend, and even further define over the cited references by reciting additional distinguishing limitations.

For example, dependent Claim 24 recites that the epitaxially depositing step includes the step of epitaxially depositing a plurality of layers, *at least two of said layers having different dopant concentrations*. Applicant respectfully submits that Boden has only *one epitaxial layer* – region 11 is part of the N⁺ substrate. Claim 25 depends from Claim 24 and further recites that the plurality of layers includes an interface layer adjacent to one of the body regions, the interface layer having a lower dopant concentration than an interior layer of the epitaxially layered material. Boden simply does not teach or suggest this element.

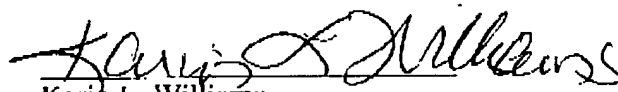
CONCLUSION

In view of the foregoing, it is believed that the application is now in condition for allowance and early passage of this case to issue is respectfully requested. Should the Examiner be of the view that an interview would expedite consideration of this Amendment or of the application at large, request is made that the Examiner telephone the Applicant's undersigned attorney at (908) 518-7700 in order that any outstanding issues be resolved.

FEES

The Examiner is authorized to charge all fees due and owing in respect to this amendment to deposit account number 50-1047.

Respectfully submitted,


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